ABSTRACT:

Up to now, the terahertz (THz) band is still an unexplored region in the sense that no practical application exists. New operating principles by traveling wave concept should be, therefore, appreciated for the real applications. In this paper, the generalized three-dimensional (3D) transverse magnetic (TM) mode analysis to analyze the characteristics of two-dimensional electron gas (2DEG) drifting plasma at the III-V high-electron-mobility-transistor (HEMT) hetero-interface such as AlGaAs/GaAs hetero-interface and its interaction with propagating electromagnetic space harmonic wave is presented. It includes, (1) the determination of electromagnetic ?elds in semiconductor drifting plasma using the combination of well-known Maxwell's equations and carrier kinetic equation based on semiconductor ?uid model and the derivation of the effective permittivity of drifting plasma in 2DEG on semi-insulating substrate, and (2) the analysis to describe the presence of interactions using a so-called interdigital-gated HEMT plasma wave devices. To describe the interaction, the admittance of the interdigital gate is evaluated. The numerical procedures to solve the integral equations which are used in determining the admittance is explained. A negative conductance is obtained when drifting carrier velocity is slightly exceed the fundamental wave velocity indicates the significant condition of the interaction. A brief analysis and discussion on the Dyakonov-Shur THz surface wave in 2DEG is also presented.